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but exceptionally complete discussions of the main relations between growth and the environmental factors. Nevertheless, the treatment of the influence of temperature lacks any mention of the conception of the temperature coefficient of growth activity, the chemical principle of Van't Hoff and Arrhenius as recently applied to physiological phenomena, although the author emphasizes the point that the phenological method of summer temperatures for the growing period can not be expected to give anything but the crudest of indications regarding the temperature relation of plants. It seems that enough has already been accomplished with the Van't Hoff-Arrhenius principle to warrant some treatment in a work of this kind. In the section on the influence of light, Palladin points out, as he has done before in the literature, that many of the developmental phenomena which are usually ascribed to light conditions should rather be referred to those of moisture. "All the characteristics of the development of etiolated plants may be explained by the altered transpiration conditions of these plants and by the resulting correlative influences of the individual organs" (p. 257).

In the last chapter of the book the author very happily presents the modern theory of internal secretions (developed from work with animals) as the basis of the physiological control of growth. "Hormones must doubtless also exist in plants." "The various phenomena of growth and of plant form will surely prove to be dependent upon different hormones" (p. 300). Such predictions, together with the activity of animal physiologists in this direction, can hardly fail to exert an accelerating influence upon the development of plant physiology.

In a general way, as clear and readable a book on this subject has not previously appeared. The style is always simple and nearly always characterized by strict logical sequence. The volume is almost without teleological implications, though the purist on this subject may smile at such an obsolescent section heading as, "The Necessity for the Movement of Materials" (p. 122), and the ex-

position thereof, which indicates that *necessity* here means *need* and not *cause*. Such must be regarded as mere slips into hitherto common and now more or less stereotyped modes of expression frequent in biological literature. The more fundamental principles are developed by the historical method, at once placing before the reader the present status of any given question and the names and methods of the workers to whom that status is due. Citations of literature are numerous, but not too numerous, and the western reader will be gratified in finding here a source for references and digests of some of the more important contributions not commonly cited in German, French and English works of this character.

On the whole, the reviewer is inclined to place Palladin's work at the head of the rather short list of books suitable to be placed in the hands of elementary students of plant physiology.

BURTON E. LIVINGSTON
THE JOHNS HOPKINS UNIVERSITY

Fourth Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum. Vol. A, Medical, 404 pp., 23 pls., 118 figs. in text. Vol. B, General Science, 333 pp., 20 pls., 101 figs. in text. ANDREW BALFOUR, M.D., Director. Published for the Department of Education, Sudan Government, Khartoum, by Bailliere, Tindall and Cox, London; Toga Publishing Co., New York City, agents for the United States.

These two highly specialized and elaborately illustrated volumes are filled from cover to cover with the results of research of high order. They are an epitome of the peaceful and effective conquest of the Sudan by the forces of modern science, of biology and chemistry, applied to the problems of the desert and the jungle in the tropics among a people submerged in ignorance and superstition and sunk in racial lethargy. The army of occupation is small, the staff of these laboratories numbering but eleven, including two officers, Captains Archibald and Fry, detailed

from the Egyptian army, and the Arab junior clerk. But the losses are heavy, for peace in the tropics claims its victims no less than war, in fatalities and sick leaves. The heavy loss to the laboratory caused by fire was promptly made good by the patron of the institution and its work has increased greatly in variety and magnitude in recent years.

This is noticeable in the accessions of volunteer helpers, Dr. Stevenson and others, and in applications for opportunity to work in the laboratory far exceed its facilities. The extensive work of this institution is carried up and down the Nile and its tributaries by the ubiquitous laboratory steamer *Culex* and by a floating laboratory equipped for researches remote from Khartoum.

For the first time the term "tropical" is added to the official title of the institution. This is particularly fitting, not only from the location, 15° 30' N., but also because this is the last outpost of civilization at the river gate to tropical Africa. It is also a natural center for the attack upon the problems which inhere in a desert environment and arise when man tames it by irrigation.

The medical volume is in large part devoted to tropical diseases of man, but likewise contains a number of important studies in bacteriology, protozoology, sanitary problems, and in that field of constantly increasing importance, comparative pathology. Lieutenant Colonel Mathias, president of the Sleeping Sickness Commission, reports upon the measures taken to check that great plague by segregation of sick natives in fly-free camps, clearing vegetation at all fords along the automobile road, and the introduction of treatment of the disease by atoxyl, metallic antimony and Ehrlich's "606."

Animal trypanosomiasis of the Sudan are discussed by Captain Fry in a very able manner. He notes that the natural conditions of this country tend to group both animal and human life in isolated colonies and hence to develop apparently isolated types of diseases which alter the virulence and characteristics of the trypanosomes which cause them. He accepts as the most reliable method of dif-

ferentiation the use of frequency polygons based on careful measurements of comparable preparations of the organisms, preferably from similar culture animals. This morphological basis in his opinion is more trustworthy than animal inoculations and reactions, culture, carrier, or the reaction to drugs, as a means of specific distinction.

An endoglobular developmental stage in the red-blood corpuscles similar to that found by Dr. Chagas in Brazil for *Schizotrypanum cruzi* is reported by Mr. Buchanon for *Trypanosoma brucei*. Captain Archibald has discovered human botryomycosis in the Sudan, the occurrence of acid-fast bacilli like *B. tuberculosis* in the lungs of the camel, and a new form of cutaneous leishmaniasis.

The work of the director, in addition to the heavy routine of administration, has included a study of the peculiar "infection granules" of fowl spirochaetosis including the life history of the spirochæte in the ticks which serve as vectors. These results have important bearings on African tick fever and other spirochætal infections of man. The specific relations of the spirochæte of human tick fever at Khartoum to *Spirochæte berbera* of Algiers is definitely established by Dr. Balfour. From his pen also comes a most useful paper on the fallacies and puzzles met with in a blood examination in the tropics and elsewhere, with a colored plate displaying the pitfalls which await the novice who searches for blood parasites, into which forsooth some experienced workers have been entrapped. A coccal form of the diphtheria bacillus is recorded from Khartoum, and Leishman nodules or non-ulcerating "oriental sores" are for the first time described.

An illuminating picture of sanitary administration is afforded in the director's account of "Some Aspects of Tropical Sanitation" in which is revealed not the militant hygiene of Panama, but another type of sanitary tyranny adapted to the life of an ignorant and fanatical people. To wage a successful war against conditions which tend to slay the white man and the black what is required is "education, such legislation as will crush the cul-

tured but ignorant fanatic and aid the worker, a devotion to the cause, and a well-trained band of helpers." In the Sudan where for many years smallpox was a dread calamity, it is now well-nigh as extinct as the dodo. The native is convinced of the beneficent results of Jenner's discovery and the anti-vaccinationist has not yet raised his voice in the desert.

The water supply of towns in the tropics and the bacterial standards to be enforced are discussed at length, with the general conclusion that the conditions are utterly different from those of civilized lands of temperate climates so that the problem of standards must be worked out anew in the tropics. Despite Clemesha's conclusions from analysis in India where soil contamination is great and sewage in streams relatively small, that the use of *Bacillus coli communis* in wider elastic sense as an indicator of contamination of water supplies in the tropics is inadequate and misleading, Dr. Balfour still concludes that this criterion gave useful results in detecting contamination in the municipal supply at Khartoum.

The second volume, devoted to general science, contains a wider range of articles, from a treatise on municipal engineering in the tropics by members of the staff of Gordon Memorial College, to a treatise on the venom of the spitting snakes of Rhodesia and the Sudan. Here are the reports of the staff chemist, Dr. Wm. Bean, and the entomologist, Dr. H. H. King, the former dealing with soil analysis, gum production, hashish and native poisons, and the latter treating of the insects destructive to crops, mosquito control and the relation of birds to insects. Experiments in exterminating mosquitoes in irrigation ditches by a small minnow of similar habit to "Millions" of the Barbados, known as *Cyprinodon dispar*, have been successful. Other biological papers deal with the mosquitoes, birds and scorpions of the region.

The anthropological interests are represented by an account of the ancient gold mines of the Sudan by Mr. S. C. Dunn, gov-

ernment geologist. The Turin papyrus (14th century B.C.) describes these mines and is accompanied by the oldest maps in existence. The cult of the Nyakang and the divine kings of the Shilluk peoples are investigated by Dr. C. G. Seligmann. The king is killed when old age or sickness threatens. Captain Anderson gives an interesting analysis of the tribal customs in their relation to medicine and morals of the Nyam Nyam and Goor peoples of the upper Sudan.

These two volumes are full of varied information, much of it of great interest and promise of permanent value. It is magnificently suggestive in its portrayal of the warfare of science on the firing line of civilization and full of incentive to the reserves at the rear.

CHARLES ATWOOD KOFOID

UNIVERSITY OF CALIFORNIA

A History of the Birds of Colorado. By WILLIAM LUTLEY SCLATER, M.A. (Oxon.), M.B.O.U., Hon. M.A.O.U. (lately Director of the Colorado College Museum). With 17 plates and a map. Witherby & Co., 326 High Holborn, London. 1912. 8vo. Pp. xxiv + 576. For United States, \$5. Edition limited to 550 copies.

This is a well-planned and thoroughly up-to-date manual of the birds of Colorado, printed on light-weight paper, and, though a bulky volume of 600 pages, is easy and comfortable to handle. The work is based primarily on the collection of Colorado birds formed by Mr. C. E. Aiken during the last thirty-five years, recently acquired by the late General William J. Palmer and presented by him to the Museum of Colorado College, of which the author of the present book was recently for some years the director.

The introduction deals briefly with the physical features of Colorado, and contains an analysis of its bird fauna, with (1) respect to the season of occurrence of the species and (2) their distribution in the state with respect to altitude. Of the 392 species thus far recorded, about 17 per cent. are resident throughout the year, while the summer resi-